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(54) **A device for the separation of particulated solids from a pressurized fluid.**

(57) The present invention relates to a device for the separation of particulated solids from a pressurized fluid, in particular from a viscous mass of a thermoplastic material, with a cleaning system for the filtration element based on the so-called "return pressure" principle.

Said device essentially comprises a body having a fluid inlet conduit, two filtration assemblies that are connected to two conduits flowing together into an outlet conduit, and a flow-dividing valve that in rest position connects the inlet conduit with the separation conduits through the filtration assemblies, whilst in the cleaning position for one of the filtration assemblies the inlet conduit is connected with the other filtration assembly, thus causing part of the fluid that has been separated by this filtration assembly to pass with counterpressure through the filtration unit that is in the cleaning stage and through a discharge outlet housed in a compartment of said valve.

In a similar manner the cleaning of the other filtration assembly is performed.

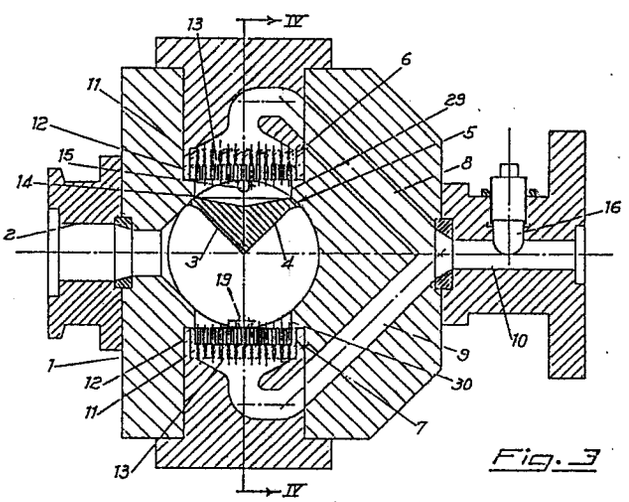


Fig. 3

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Description

"A DEVICE FOR THE SEPARATION OF PARTICULATED SOLIDS FROM A PRESSSURIZED FLUID"

The present invention mainly relates to a device for the separation of particulated solids from a pressurized fluid, in particular from a highly viscous mass of a thermoplastic material, to be implemented on machines for the extrusion of said materials.

It is well known that the filters provided on said devices are affected by gradual clogging due to the deposition of fouling particulated solids within the filters. Thus, after reaching a certain clogging level, it becomes necessary to clean said filters by means of the sp-called "return pressure" principle.

Several patents have been published relating to this subject. German Patent No 2 502 669 is to be considered as the most meaningful among them. Said patent teaches a device comprising a filtration assembly consisting of a circular foraminated throughput block in the interior of which the filter cloth is housed, said filter cloth being divided into a plurality of circular sectors, each of said circular sectors forming a throughput chamber that is tighly sealed against the remaining sectors. A rotary gate valve having a shape almost corresponding with that of a sector and the pivotal axis of which passes through the center-point of the circular throughput block is placed, in rest position, on a circular sector of the throughput block having no throughput holes. When the gate valve, suitably operated, turns a full 360° starting from the rest position and returning to the rest position, it passes in front of all the circular sectors of the block and tighly occludes them on the fluid inlet side for a very short time, thus causing the inlet-side pressure to drop. Since in the internal wall of the gate valve there is a conduit communicating with the outside, as the gate valve occludes a circular sector the amount of non filtered fluid that is in the depressurization chamber thus created between the gate valve and the throughput block is forcefully caused to flow outside through said outlet conduit, due to the pressure of the filtered fluid that is on the discharge side of the filtration block.

In this way, every time the gate valve passes in front of the circular sectors forming the filtration block the fouling particulated solids that, due to the delivery pressure, have accumulated on the wall of said block are eliminated with no substantial prejudice to the filtration flow.

Nevertheless, the devices that are based upon the above-mentioned German Patent show the following drawbacks:

- The tight-seal gate valve, in the closing phase of every circular sector, can meet fouling particles, like iron, wood or other particles, that hinder a perfect closing due to the interposition of said particles between the wall of the stationary sector and the rotary wall of the gate valve; this results in a jamming of the intersted sector.
- The device necessarily operates with a high pressure on the discharge side of the filter, due to the following reasons: 1) Since the gate valve is moving, the time it closes a circular sector is practically infinitesimal, therefore it is necessary to compensate the quite short depressurization by increasing the pressure on the discharge side of the filter, also taking into account the delay of return response of the fluid, due to its elasticity.

2) The pressure on the discharge side of the filter must also be kept high to compensate for the high pressure drop the fluid undergoes because it passes through an outlet conduit that is necessarily long and tortuous. This high pressure on the discharge side of the filter not only causes an expensive increase in the energy consumption, but in certain cases an over-pressure is not even allowed due to the nature of the fluid to be filtered and, in other cases, typically in the field of thermoplastic materials, it is incompatible with other situations of the system that demand the process to be carried out below a certain critical pressure. A typical example is offered by extrusion with degassing where, by exceeding such a critical pressure, the fluid is caused to flow back and come out of the degassing valve.

- The flow capacity of the device according to the above-mentioned Patent is seriously affected by the diameter of the throughput - filtration block. In fact, since the discharge outlet in the internal wall of the gate valve is located nearby the centre of the block and is therefore in an opposite position relative to the circumferential periphery of the filtration block, excessively enlarging its diameter for the purpose of increasing its flow capacity would lead to having an excessive distance between the circumferential periphery and the discharge point, with serious deviations of the outlet flow and alteration of the homogeneity of discharge.

It is an object of the present invention to eliminate the above-mentioned drawbacks by providing a device providing the following advantages:

- It makes it possible to increase to the maximum level the flow capacity of the filter with a double filtration area.
- It provides a "return pressure" purification system that acts simultaneously on the whole area of the filtration element by conveying the discharge material without deviation of the outlet flow.
- It provides a minimal operating pressure on the discharge side of the filter by pressurizing-depressurizing the whole filter simultaneously during the whole time of a few seconds corrresponding to the purging cycle and causing the return fluid during discharge to undergo a minimal head loss thanks to a suitable configuration of the conduit.

It is another object of the present invention to provide a highly reliable, functional device that can be built at a low cost and does not require frequent maintenance.

These and other objects are all achieved by the subject device, that it characterized in that it comprises a fluid inlet conduit, two filtration assemblies communicating with two separation conduits

that flow together into an outlet conduit, and a valve that is so shaped that when the valve is in the rest position the fluid entering through the inlet conduit passes through the filtration assemblies and along said two separation conduits, while, when the valve is moved into a position corresponding with and tightly closing the first filtration assembly, the return pressure fluid that is being discharged passes through said filtration asembly, said pressurized fluid being derived from at least part of the fluid that has been separated by the second filtration assembly and, similarly, when the valve is moved into a position corresponding with and tightly closing the second filtration assembly, the return pressure fluid that is being discharged passes through said filtration assembly, said pressurized fluid being derived from at least part of the fluid that has been separated by the first filtration assembly.

The features and advantages of the invention will be evident from the following detailed description of a preferred non-limiting embodiment of the subject device taken in conjunction with the accompanying drawings, in which:

- FIGURE 1 is a horizontal cross sectional view of the device according to the present invention;
- FIGURE 2 is a view of the valve of the device according to the present invention taken along arrow A of figure 1;
- FIGURE 3 is a horizontal cross-sectional view of the device according to the present invention with the valve in one of the two positions in which the pressurized fluid is caused to flow back;
- FIGURE 4 is a cross-sectional view of the device taken along the line IV-IV of figure 3; and
- FIGURE 5 is a top view of the driving members of the valve.

Referring now to figures 1 and 2, the body 1 of the device comprises an inlet conduit 2 through which the pressurized fluid passes, said fluid being in particular a molten, highly viscous mass of a thermoplastic material passing through the communicating chambers 3 and 4 of a cylindrical rotary valve 5. When said valve 5 is in the position of figure 1, the fluid passes through the filtration assemblies 6 and 7 and then through two separation conduits 8 and 9 that flow into the same outlet conduit 10. The filtration assemblies 6 and 7 both consist of foraminated plates 11 and 12 and filtration elements 13, normally wire meshes or foraminated metal sheets.

Valve 5 comprises, besides the chambers 3 and 4, an opening 14 that ends with an outlet 15 that is in a lower position than said opening, whilst at the outlet conduit 10 there is provided a flow-rate control valve.

As can be seen from figures 1 and 4, the lower closing plate 17 of body 1 includes two holes 18 and 19 on opposite sides relative to the axis 20 of valve 5 and facing the filtration assemblies 6 and 7 respectively.

Figure 5 shows the device 21, that is suitable to cause the cylindrical valve 5 to rotate around axis 20 for it to reach the two cleaning positions for said filtration assemblies 6 and 7. Said device 21 comprises two hydraulic rams 22 and 23 that are hinged in 22' and 23' respectively, the pistons of which are secured to stems 24 and 25, respectively hinging in 24' and 25' around arms 26 and 27 which, in turn, are rigidly connected with the hub 28 of valve 5.

When cylinder 22 is actuated, stem 24 causes the arm 27 to rotate into the phantom position 27' and valve 5 is caused to rotate into the position shown in figures 4 and 5, thus bringing the opening 14 to tightly face the inlet 29 of the filtration assembly 6, that is in the cleaning position of said filtration assembly 6, as will be described in more details below. After stopping for a while, the cylinder 22 causes the arms 26 and 27 to return to the original position together with valve 5, thereafter cylinder 23 is operated and its piston-rod 25 causes the arm 26 to rotate into the phantom position 26' and in this position of valve 5 the opening 14 tightly faces the inlet 30 of the filtration assembly 7, for the cleaning thereof.

As can be seen in figure 5, there are provided two shafts 31 and 32 that can be operated by hand by means of handle-bars 33 and 34, said shafts being connected with the filtration assemblies 6 and 7 respectively for their removal from the working seat when they have to be maintained or replaced.

The device of the present invention works in the following manner

when valve 5 is in the position shown in figure 1, the pressurized fluid enters through the inlet conduit 2 and is distributed by chambers 3 and 4 through inlets 29 and 30 to the filtration assemblies 6 and 7, and, after having been cleaned of the fouling particles, it flows through the separation conduits 8 and 9, eventually flowing toghether in the outlet conduti 10.

When, due to the gradual clogging of the filtration assemblies 6 and 7, which in turn is due to the deposition of fouling solid particles, a certain critical preset pressure is reached on the inlet side of the filtration assemblies 6 and 7, said pressure being suitably measured by a pressure gauge, not shown in the figures, the hydraulic rams 22 and 23 are alternately and successively actuated, thus causing the valve 5 to rotate into the above-mentioned positions. When the valve 5 is in the position shown in figures 3 and 4, outlet 15 is superimposed on hole 18 so that the fluid entering through the inlet conduit 2 passes through the filtration assembly 7 and the separation conduit 9 and is then divided into a stream going through the outlet conduit 10 and another stream flowing through the separation conduit 8 with a return pressure on the discharge side of the filtration assembly 6. In this condition opening 14 becomes a depressurization chamber due to the pressure difference thus created between the fluid on the discharge side of the filtration assembly 6 and the outlet 15, thereby eliminating through the outlet 15 all the fouling particulated solids deposited on the walls of the filtration assembly 6, with no substantial prejudice to the filtration flow through the other filtration assembly 7. Evidently, the control valve 16 is used to exactly control the return flow rate through outlet 15, and

the dwelling time of the opening 14 in front of the filtration assembly 6 is adjustable.

At the end of said dwelling time, cylinder 22 causes the valve 5 to return into the original position, while cylinder 23 is actuated to carry out a similar cleaning operation of the filtration assembly 7. Thereby, part of the pressurized fluid that has been filtered by the filtration assembly 6 reaches the discharge side of the filtration assembly 7 thereby building up a counter pressure, so that opening 14 becomes a depressurization chamber thanks to the pressure difference thus created between the fluid that is on the discharge side of the filtration assembly 7 and the outlet 15, now superimposed on hole 19.

It is to be understood that various changes can be brought into the described embodiment without departing from the scope of the invention. For example, the hydraulic rams 22 and 23 can be substituted by equivalent mechanical members suitable to cause valve 5 to rotate into the above-mentioned positions without departing from the scope of the present invention as it is defined in the following claims.

It can moreover be especially useful to connect holes 18 and 19 to a small screw-extruder so that, when said screw is still-standing, no purge material gets out, whilst by changing the r.p.m. of said extruder the flow-rate of the purge material can be controlled, said purge material being suitably granulated by a suitable cutting system provided on the head of said extruder.

Finally, chambers 3 and 4 of the cylindrical valve 5 can be suitably connected with each-other by providing a channel on the periphery of said valve above opening 14 in such a way that said channel does not interfere with said opening. With this embodiment the benefit is obtained that the fluid pressure is uniform, thereby relieving any stress on valve due to the thrust of the fluid mass pressing said valve against its seat, said fluid coming from the inlet conduit 2. Also the risk is avoided that the fluid, that consists of molten polymer, stops in the chambers that divide the flow into streams to the filtration assemblies 6 and 7, due to the fact that the fluid is forcefully caused to continuously flow through said channel.

Claims

1. A device for the separation of particulated solids from a pressurized fluid, in particular from a highly viscous mass of a thermoplastic material, with cleaning of the filtration element based on the principale of return pressure, characterized in that it comprises a fluid inlet conduit (2), two filtration assemblies (6, 7) communicating with two separation conduits (8, 9) that flow together into an outlet conduit (10), and a valve (5) whose shape is such that when valve (5) is in the rest position the fluid entering through the inlet conduit (2) passes through the filtration assemblies (6, 7) and then flows through said separation conduits (8,9), whilst when valve (5) is moved to tightly face the first filtration assembly (6) the fluid under return pressure that is being discharged passes through said first filtration assembly, said pressurized fluid deriving from at least part of the fluid that has been separated by the second filtration assembly (7), and, similarly, when valve (5) is moved to tightly face the second filtration assembly (7) the fluid under return pressure that is being discharged passes through said second filtration assembly, said pressurized fluid deriving from at least part of the fluid that has been separated by the first filtration assembly (6).

2. A device as claimed in claim 1, characterized in that said valve (5) is a cylindrical valve and comprises two communicating chambers (3, 4) and an opening (14) that ends into an outlet (15), said opening being placed on the opposite side relative to said two chambers (3, 4) so that when valve (5) is in rest position the entering fluid passes through said two chamberw (3, 4), through said filtration assemblies (6, 7) and flows along said two separation conduits (8, 9), whilst when valve (5) is rotated until said opening (14) is brought to tightly face said first filtration assembly (6), said fluid under return pressure coming from the filtration assembly (7) is discharged through outlet (15) and similarly, when valve (5) is rotated until said opening (14) is brought to tightly face the second filtration assembly (7), said fluid under return pressure coming from the filtration assembly (6) is discharged through said outlet (15).

3. A device as claimed in claim 2, characterized in that said filtration assemblies (6, 7) face each other and are provided with two inlets (29, 30) on which opening (14) is tightly superimposed when valve (5) is rotated into the two positions respectively facing each of said filtration assemblies (6, 7)

4. A device as claimed in claim 2, characterized in that said device comprises a lower opening (17) having two holes (18, 19) on which said outlet (15) is superimposed in the two positions valve (5) takes relative to said filtration assemblies (6, 7), respectively.

5. A device as claimed in claim 2, characterized in that said outlet conduit (10) comprises a control valve (16) to control the flow rate of the return stream through outlet (15) in the positions said outlet (15) takes facing hole (18) or (19) in said two positions said valve (5) takes.

6. A device as claimed in any of the precedent claims characterized in that there is provided a pressure controller that detects the pressure on the inlet side of said filtration assemblies (6, 7) said pressure, after reaching a preset value, actuating the members that cause said valve to be moved until it takes one of the two above mentioned positions.

7. A device as claimed in claim 6, charac-

terized in that said members consist of two hydraulic rams (22, 23) that are connected with two arms (26, 27), said arms driving valve (5) to bring it into the two above-mentioned positions.

8. A device as claimed in claim 2, characterized in that said cylindrical valve (5) is caused to pivot around its axis (20).

9. A device as claimed in claim 1, characterized in that said filtration assemblies (6, 7) are connected with a translation mechanism that is suitable to move said assemblies from and into their seats.

10. A device as claimed in claim 4, characterized in that said outlet holes (18, 19) are connected with a screw extruder that is caused to turn with a variable speed, thereby controlling the outlet flow-rate, or can be brought to still-stand in such a position that it stops said fluid from flowing out.

11. A device as claimed in claim 2, characterized in that said two chambers (3, 4) are connected with each-other through a channel, said channel being provided on the periphery of said cylindrical valve (5) in such a way that it does not interfere with said opening (14).

Fig.1

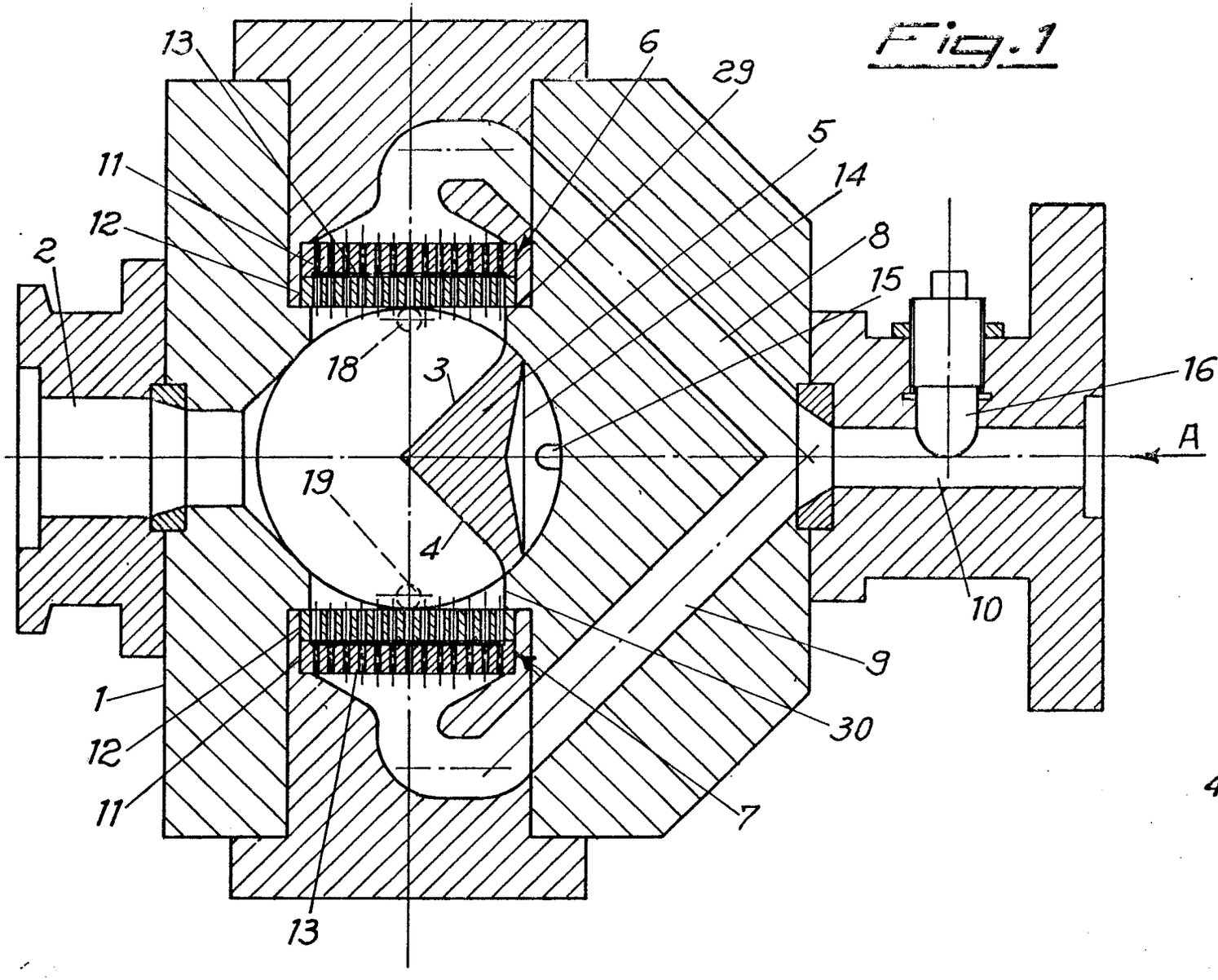
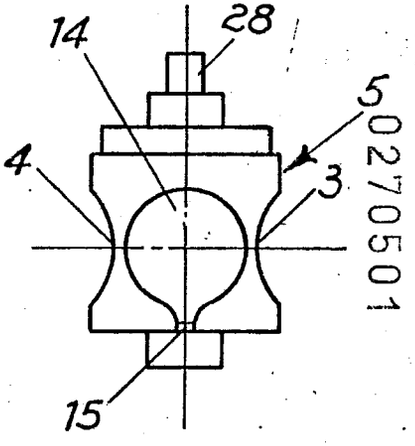


Fig.2



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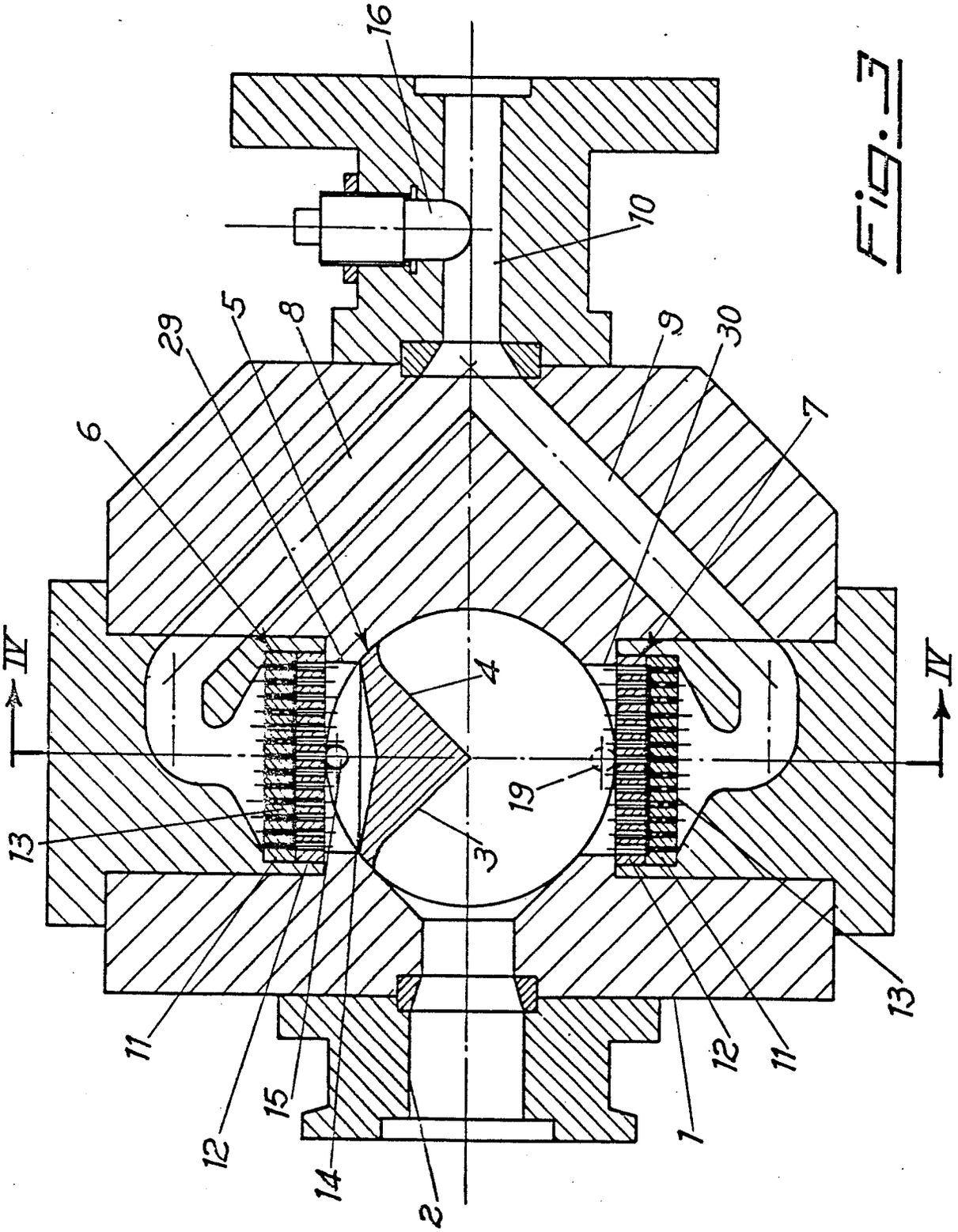


Fig. 3

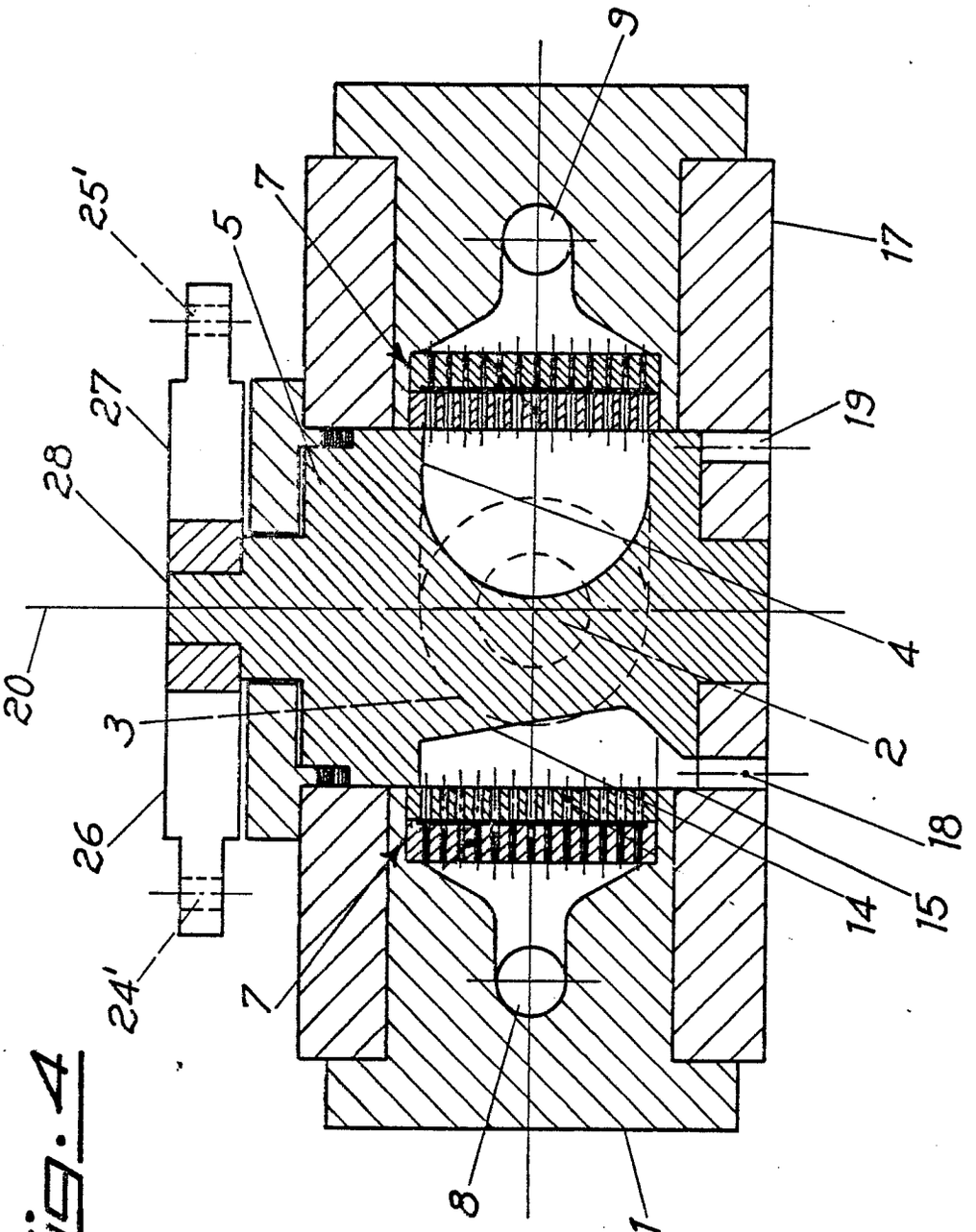


Fig. 4

Fig. 5

